

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA20 | Curdworth to Middleton

Water resources assessment (WR-002-020)

Water resources

November 2013

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Department
for Transport

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Appendix WR-002-020

Environmental topic:	Water resources and flood risk assessment	WR
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1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

- 1.1.1 The water resources and flood risk assessment appendices comprise four parts. The first of these is a route-wide appendix (Appendix WR-001-000).
- 1.1.2 Three specific appendices for each community forum area (CFA) are also provided. For the Curdworth to Middleton area (CFA20), these are:
- a water resources assessment (i.e. this appendix);
 - a flood risk assessment (Appendix WR-003-020); and
 - a river modelling appendix (Appendix WR-004-013).
- 1.1.3 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5: Map Book – Water resources, Maps WR-01 to WR-03, WR-05 and WR-06 and the Volume 5: Map Book – Ecology, Maps EC-01 to EC-04.

1.2 Study area

- 1.2.1 The study area is located between Hams Hall Distribution Park and Middleton and is within the county of Warwickshire. The Curdworth to Middleton area is rural and overlies several superficial and bedrock aquifers. Topography varies from 70 to 100m above ordnance datum (AOD).
- 1.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centreline of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centreline, for example at the Marston railhead, a professional judgement was made in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this is defined as the study area. Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the scheme, or within the calculated zone of influence (i.e. those potentially affected by the Proposed Scheme) have been detailed in the baseline.

2 Stakeholder engagement

2.1.1 Discussions with the following stakeholders has been undertaken to inform the water resources assessment:

- the Environment Agency on 31 September 2012 to discuss multiple aspects of the Proposed Scheme;
- the Environment Agency on 21 December 2012; and
- the Environment Agency and Warwickshire County Council (WCC) as Lead Local Flood Authority (LLFA) on 4 June 2013.

3 Baseline data

- 3.1.1 The following section provides a current description of water resources including surface water and groundwater.

3.2 Surface water features

- 3.2.1 All surface water features within 1km of the route are presented in Table 1.
- 3.2.2 The current surface water baseline is shown in the Volume 5: Maps WR-01-033 and WR-01-034. Where a water feature in Table 1 has been given a map reference it appears on one of these maps.

Appendix WR-002-020 | Baseline data

Table 1: Surface water features within 1km of the route in the Curdworth to Middleton study area

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
River Tame	Downstream of Curdworth Bridge, will be crossed by the route. Map WR-01-033 (G6) (SWC-CFA20-001)	Main river	River Tame from confluence of the two arms to River Blythe (GB104028046840) – Moderate Potential	Good Potential	Very high	2.22m ³ /s	River Tame	408km ²	
Tributary of River Tame	South-east of Spring Farm and the M42 motorway, will be crossed by the route. Map WR-01-033 (G6) (SWC-CFA20-002)	Ordinary watercourse	River Tame from confluence of the two arms to River Blythe (GB104028046840) – Moderate Potential	Good Potential	Moderate	0.008m ³ /s	River Tame	9.032km ²	
Tributary of River Tame	West of Edison Road, will be crossed by the route. Map WR-01-033 (G6) (SWC-CFA20-003)	Ordinary watercourse	River Tame from confluence of the two arms to River Blythe (GB104028046840) – Moderate Potential	Good Potential	Moderate	0m ³ /s	River Tame	0.208km ²	

¹ Only ponds within the land required for the permanent Proposed Scheme are listed in this table.

² Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-033 and WR-01-034.

³ Environment Agency water-feature classification: The Land Drainage Act 1991 defines an Ordinary watercourse as 'A watercourse that is not part of a main river, all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. 'Main Rivers' are larger rivers and streams designated by DEFRA, main rivers are regulated by the Environment Agency.

⁴ Year may vary in different RBMPs.

⁵ The Environment Agency (2009), *River Basin Management Plan – Humber River Basin District* (p14).

⁶ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

⁷ Q95 flow values only provided for water features crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of River Tame	At Newlands Farm, will be crossed by the route Map WR-01-033 (G6) (SWC-CFA20-004)	Ordinary watercourse	River Tame from confluence of the two arms to River Blythe (GB104028046840) – Moderate Potential	Good Potential	Moderate	om ³ /s	River Tame	0.208km ²	
Drain	West of M42 at Spring Farm, 670m west of the route. Map WR-01-033 (G6)	Ordinary watercourse	River Tame from confluence of the two arms to River Blythe (GB104028046840) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain	At Newlands Farm, 40m west of the route under landscaping works. Map WR-01-033 (F6)	Ordinary watercourse	River Tame from confluence of the two arms to River Blythe (GB104028046840) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain	At Faraday Avenue, will be crossed by the route. Map WR-01-033 (F6) (SWC-CFA20-005)	Ordinary watercourse	River Tame from confluence of the two arms to River Blythe (GB104028046840) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	
Drain	In Sych Wood, 810m east of the route. Map WR-01-033 (F5)	Ordinary watercourse	River Tame from River Blythe to River Anker (GB104028046440) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.
Birmingham and Fazeley Canal	At White Bridge Lower Mill Plantation, will be crossed by the route. Map WR-01-033 (G5) (SWC-CFA20-006)	Not applicable	Birmingham and Fazeley Canal upper section (GB70410515) – Moderate Potential	Good Potential	High	-	River Tame	-	

Appendix WR-002-020 | Baseline data

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Pond	Pond No.1 At Cuttle Mill Fishery, will be crossed by the route. Map WR-01-033 (D5) (SWC-CFA20-007)	Not applicable			Refer to ecology, Volume 2, CFA Report 20, Section 7	-		-	
Pond	Pond No.2 at Cuttle Mill Fishery, will be crossed by the route. Map WR-01-033 (D5) (SWC-CFA20-008)	Not applicable			Refer to ecology, Volume 2, CFA Report 20, Section 7	-		-	
Tributary of River Tame	At Heath House Farm, 940m east of the route. Map WR-01-033 (C4)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Watercourse	Tributary feeder to Birmingham and Fazeley Canal at Cheatles Farm Bridge Bodymoor Heath, 280m east of the route. Map WR-01-033 (C5)	Ordinary watercourse	Birmingham and Fazeley Canal upper section (GB70410515) – moderate status	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain feeder to Birmingham & Fazeley Canal	On The Homestead Farm, 300m east of the route. Map WR-01-034 (F5)	Ordinary watercourse	Birmingham and Fazeley Canal upper section (GB70410515) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Lake/reservoir	At Middleton Plantation, 540m west of the route. Map WR-01-034 (F7)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Tributary of Langley Brook	At Cuttle Mill Fishery, will be crossed by the route. Map WR-01-033 (C5) (SWC-CFA20-009)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	0.002m ³ /s	River Tame	3.014km ²	
Tributary of Langley Brook	At Middleton House Farm, will be crossed by the route. Map WR-01-034 (F6) (SWC-CFA20-010)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	0.005m ³ /s	River Tame	5.551km ²	
Tributary feeder to Birmingham & Fazeley Canal	At Middleton House Farm, 45m east of the route. Map WR-01-034 (F6)	Ordinary watercourse	Birmingham & Fazeley Canal upper section (GB70410515) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Tributary of Langley Brook	At Lower Farm Cottages Bodymoor Heath Lane, 435m east of the route. Map WR-01-034 (F5)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.

Appendix WR-002-020 | Baseline data

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain	At Lower Farm Cottages Bodmoor Heath Lane, 540m east of the route. Map WR-01-034 (F5)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Tributary of Langley Brook	At Primrose Cottage, will be crossed by the route. Map WR-01-034 (F6) (SWC-CFA20-011)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	0.002m ³ /s	River Tame	2.313km ²	
Tributary of Langley Brook	At Lower Farm, 480m east of the route. Map WR-01-034 (F5)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Lake/reservoir	In hydraulic connectivity to feeder tributary of Langley Brook at Maple Leaf Farm, 450m west of the route. Map WR-01-034 (F6)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Pond	On A4091 Tamworth Road, 90m west of the route under landscaping works. Map WR-01-034 (F6)	Not applicable			Refer to ecology, Volume 2, CFA Report 20, Section 7	-	River Tame	-	Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Lake/reservoir	In hydraulic connectivity to feeder tributary of Langley Brook west of Wishaw Lane, 980m west of the route. Map WR-01-034 (E7)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain feeder to Langley Brook	At Brick Kiln lane, will be crossed by the route. Map WR-01-034 (E6) (SWC-CFA20-012)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	0.002m ³ /s	River Tame	2.313km ²	
Drain	Feeder to Langley Brook on Lower Farm, 780m east of the route. Map WR-01-034 (F4)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain	Feeder to Langley Brook on Coneybury Farm, 780m east of the route. Map WR-01-034 (E4)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Tributary of Langley Brook	At Coneybury Wood, 460m east of the route. Map WR-01-034 (E5)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.

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Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Langley Brook	At Coneybury Wood, 260m east of the route. Map WR-01-034 (E5)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Tributary of Langley Brook	At Coneybury Farm, 650m east of the route. Map WR-01-034 (E4)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Lake/reservoir	At Coneybury Farm, 720m east of the route. Map WR-01-034 (E4)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain feeder to Langley Brook	At Coneybury Farm, 1km east of the route. Map WR-01-034 (E4)	Ordinary watercourse	Middleton Hall catchment – tributary of Langley Brook (GB104028046850) – Moderate Potential	Good Potential	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain feeder to Langley Brook	At Pool-Head Plantation, 200m east of the route. Map WR-01-034 (D5)	Ordinary watercourse	Langley Brook from source to Middleton Hall catchment (GB104028046890) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.
Lake/reservoir	Middleton Pool, 340m east of the route. Map WR-01-034 (D5)	Ordinary watercourse	Langley Brook from Source to Middleton Hall Catchment (GB104028046890) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary to Middleton Pool	At Kennels Wood, 730m east of the route. Map WR-01-034 (D4)	Ordinary watercourse	Langley Brook from Source to Middleton Hall Catchment (GB104028046890) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.
Drain feeder to Langley Brook	At Walkers Spinney Crowberry Lane, 260m west of the route. Map WR-01-034 (D6)	Ordinary watercourse	Langley Brook from Source to Middleton Hall Catchment (GB104028046890) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.
Langley Brook	At Middleton Pool Walkers Spinney, will be crossed by the route. Map WR-01-034 (D5) (SWC-CFA20-013)	Ordinary watercourse	Langley Brook from Source to Middleton Hall Catchment (GB104028046890) – Poor Status	Good Status	High	0.02m ³ /s	River Tame	16.54km ²	
Drain feeder to Gallows Brook	On Middleton Park, 560m east of the route. Map WR-01-034 (D4)	Ordinary watercourse	Langley Brook from Source to Middleton Hall Catchment (GB104028046890) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.
Tributary of Langley Brook	At Vicarage Hill, 760m west of the route. Map WR-01-034 (D6)	Ordinary watercourse	Langley Brook from Source to Middleton Hall Catchment (GB104028046890) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.
Tributary of Langley Brook	At The Old Smithy, 940m west of the route. Map WR-01-034 (D6)	Ordinary watercourse	Langley Brook from Source to Middleton Hall Catchment (GB104028046890) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.

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Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name, identifier and overall status	WFD objective (by 2027 ⁴ as per River Basin Management Plan (RBMP ⁵) unless stated	Receptor value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Gallows Brook	North of Church Lane, 200m east of the route. Map WR-01-034 (C5)	Ordinary watercourse	Langley Brook from Middleton Hall catchment to River Tame (GB104028046900) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.
Gallows Brook	East of Upper House Farm, will be crossed by the route. Map WR-01-034 (C6) SWC-CFA20-014	Ordinary watercourse	Langley Brook from Middleton Hall catchment to River Tame (GB104028046900) – Poor Status	Good Status	Moderate	0	River Tame	0.57km ²	
Langley Brook	North of Gallows Brook at Brook Farm, 70m east of the route. Map WR-01-034 (B6)	Main river	Langley Brook from Middleton Hall catchment to River Tame (GB104028046900) – Poor Status	Good Status	High	-	River Tame	-	Will not be crossed by the route.
Tributary of River Tame	At Trickley Coppice, will be crossed by the route. Map WR-01-034 (B6) SWC-CFA20-015	Ordinary watercourse	Langley Brook from Middleton Hall catchment to River Tame (GB104028046900) – Poor Status	Good Status	Moderate	0.002m ³ /s	River Tame	2.055km ²	
Drain	At Trickley Coppice, 995m west of the route. Map WR-01-034 (B8)	Ordinary watercourse	Langley Brook from Middleton Hall catchment to River Tame (GB104028046900) – Poor Status	Good Status	Moderate	-	River Tame	-	Will not be crossed by the route.

3.2.3 Table 2 summarises licensed surface water abstractions within 1km of the route⁸. Information from North Warwickshire District Council indicates that there are no unlicensed abstractions from surface water used for potable supply in their records.

Table 2: Licensed surface water abstractions

Licence identifier (Environment Agency reference and map reference number ⁹)	Distance from route	Abstraction source	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Purpose
03/28/16/0044 Map WR-01-033 (E7)	865m west of the route	Birmingham and Fazeley Canal at Wishaw, Sutton Coldfield	20,457m ³	20,457m ³	Spray irrigation – storage
03/28/16/0032 Map WR-01-033 (E7)	675m west of the route	Curdworth, Birmingham and Fazeley Canal	Not known	Not known	Spray irrigation – direct
03/28/16/0019 Map WR-01-033 (C5)	65m east of the route	Rye Farm, Wishaw – Tributary Cuttle Mill Brook	30,000m ³	456m ³	Spray irrigation – direct
03/28/16/0090/1 Map WR-01-033 (C7)	945m west of the route	The Belfry – Brabazon Lake 5	146,000m ³	400m ³	Transfer between sources
03/28/16/0074 Map WR-01-033 (C7)	545m west of the route	The Belfry, Wishaw – Moxhull Brook	157,680m ³	432m ³	Lake and pond throughflow
03/28/16/0058 Map WR-01-034 (D6)	280m south- west of the route	Parkwood House Farm – Langley Brook	7,300m ³	680m ³	Spray irrigation – direct
03/28/16/0028 Map WR-01-034 (D6)	105m south- west of the route	Middleton – Langley Brook (Point A)	62,730m ³	654m ³	Spray irrigation – storage
03/28/16/0028 Map WR-01-034 (D6)	105m south- west of the route	Middleton – Langley Brook (Point A)	62,730m ³	654m ³	Spray irrigation – direct
03/28/16/0028 Map WR-01-034 (D6)	85m south-west of the route	Middleton – Langley Brook (Reach)	62,730m ³	654m ³	Spray irrigation – direct
03/28/16/0028 Map WR-01-034 (D6)	85m south-west of the route	Middleton – Langley Brook (Reach)	62,730m ³	654m ³	Spray irrigation – storage
03/28/16/0022/S Map WR-01-034 (D7)	965m south- west of the route	Church Farm, Middleton, Tamworth – Langley Brook	4,546m ³	818m ³	Spray irrigation – direct

3.2.4 Table 3 summarises surface water discharge consents within 1km of the route.

⁸ Surface water abstractions for public supply are not included.

⁹ Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-033 and WR-01-034.

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Table 3: Permitted discharges to surface water

Reference number and map reference ¹⁰	Permit identifier	Distance from route	Discharge type	Receiving water body
97332045 Map WR-01-033 (G4)	T/10/36212/R	940m east of the route	Sewage discharge	River Tame
97332041 Map WR-01-033 (G4)	T/10/35431/R	940m east of the route	Sewage discharge	River Tame
68892920 Map WR-01-033 (G4)	T/10/36212/R	940m east of the route	Sewage discharge	River Tame
1473199 Map WR-01-033 (G4)	T/10/12117/R	940m east of the route	Sewage discharge	River Tame
19449307 Map WR-01-033 (G4)	T/10/35431/R	940m east of the route	Sewage discharge	River Tame
97332043 Map WR-01-033 (G4)	T/10/36212/R	940m east of the route	Sewage discharge	River Tame
97332044 Map WR-01-033 (G4)	T/10/36212/R	940m east of the route	Sewage discharge	River Tame
26342703 Map WR-01-033 (G4)	T/10/35431/R	940m east of the route	Sewage discharge	River Tame
19449303 Map WR-01-033 (G4)	T/10/35431/R	940m east of the route	Sewage discharge	River Tame
1465832 Map WR-01-033 (G5)	T/10/22589/T	405m east of the route	Trade discharge	River Tame
26342571 Map WR-01-033 (F5)	T/08/36019/T	400m east of the route	Trade discharge	Tributary of River Tame
1465811 Map WR-01-033 (F5)	CT/10/02210/T 2	385m east of the route	Surface water discharge	River Tame
1465814 Map WR-01-033 (F5)	CT/10/02210/T 3	385m east of the route	Surface water discharge	River Tame
1465829 Map WR-01-033 (F5)	CT/10/02210/T 4	385m east of the route	Surface water discharge	River Tame
26342572 Map WR-01-033 (F5)	T/08/36019/T	540m east of the route	Trade discharge	Tributary of River Tame

¹⁰ Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-033 and WR-01-034.

Reference number and map reference ¹⁰	Permit identifier	Distance from route	Discharge type	Receiving water body
1466053 Map WR-01-033 (E5)	T/14/35382/S	730m east of the route	Sewage discharge	Tributary of River Tame
31292703 Map WR-01-033 (D7)	T/16/36108/T	620m west of the route	Sewage discharge	Unnamed tributary of Langley Brook
1465146 Map WR-01-033 (D6)	T/16/02130/S	85m west of the route	Sewage discharge	Tributary of River Tame
1465337 Map WR-01-033 (C5)	T/16/20569/S/1	540m north-east of the route	Sewage discharge	Lower Farm Brook
1465424 Map WR-01-033 (C5)	T/16/35091/S	540m north-east of the route	Sewage discharge	Lower Farm Brook
20358200 Map WR-01-033 (C7)	T/16/35709/S	870m south-west of the route	Sewage discharge	Tributary of Langley Brook
21510501 Map WR-01-033 (C7)	T/16/35820/T	870m south-west of the route	Sewage discharge	Tributary of Langley Brook
1465175 Map WR-01-033 (C7)	T/16/11470/S	870m south-west of the route	Sewage discharge	Tributary of Langley Brook
1465328 Map WR-01-034 (E4)	T3773	795m east of the route	Trade discharge	Tributary of Langley Brook
1465333 Map WR-01-034 (E4)	T3773	795m east of the route	Trade discharge	Tributary of Langley Brook
1465222 Map WR-01-034 (E4)	T/16/07024/T/1	770m east of the route	Trade discharge	Coneybury Brook (Tame)
37193054 Map WR-01-034 (E5)	T/16/36385/T	155m east of the route	Trade discharge	Tributary of Langley Brook
94022654 Map WR-01-034 (E7)	Eprfp3620xq	940m west of the route	Sewage discharge	Tributary of River Tame
22690489 Map WR-01-034 (D4)	T/16/35922/T	845m east of the route	Sewage discharge	Langley Brook
26342710 Map WR-01-034 (D4)	T/16/36001/T	760m east of the route	Sewage discharge	Langley Brook
22690754 Map WR-01-034 (D6)	T/16/35964/R	90m south-west of the route	Trade discharge	Langley Brook
22690752 Map WR-01-034 (D6)	T/16/35964/R	90m south-west of the route	Sewage discharge	Langley Brook

Reference number and map reference ¹⁰	Permit identifier	Distance from route	Discharge type	Receiving water body
68892980 Map WR-01-034 (D6)	T/16/35964/R	90m south-west of the route	Sewage discharge	Langley Brook
68892981 Map WR-01-034 (D6)	T/16/35964/R	90m south-west of the route	Sewage discharge	Langley Brook
1465326 Map WR-01-034 (D6)	T/16/08726/R	90m south-west of the route	Sewage discharge	Langley Brook
22690751 Map WR-01-034 (D6)	T/16/35964/R	90m south-west of the route	Sewage discharge	Langley Brook
1465327 Map WR-01-034 (D6)	T/16/08726/R	90m south-west of the route	Sewage discharge	Langley Brook
22690750 Map WR-01-034 (D6)	T/16/35964/R	90m south-west of the route	Sewage discharge	Langley Brook
22690753 Map WR-01-034 (D6)	T/16/35964/R	90m south-west of the route	Sewage discharge	Langley Brook
1465214 Map WR-01-034 (D5)	T/16/03748/S/1	470m north-east of the route	Sewage discharge	River Tame
1465213 Map WR-01-034 (D5)	T/16/03747/S	470m north-east of the route	Sewage discharge	Tributary of River Tame
1465345 Map WR-01-034 (D6)	T/16/02646/O	295m south-west of the route	Sewage discharge	Langley Brook
1465425 Map WR-01-034 (D5)	T/16/35111/S	540m north-east of the route	Sewage discharge	Tributary of River Tame

3.3 Groundwater

- 3.3.1 The study area crosses the Tame Anker Mease – Secondary Combined groundwater body (GB40402G990800). This groundwater body is within Mercia Mudstone Group rocks.
- 3.3.2 The groundwater within is currently of good quantitative quality and poor chemical quality status.
- 3.3.3 The alluvium, river terrace deposits and the glaciofluvial deposits are classified as Secondary A aquifers.
- 3.3.4 The bedrock of the Mercia Mudstone Group is classified as a Secondary B aquifer and Head Deposits are classified as a Secondary (undifferentiated) aquifer.
- 3.3.5 Glaciolacustrine deposits are classified as unproductive strata.

- 3.3.6 No groundwater source protection zones (SPZ) are present within the study area).
- 3.3.7 Six licensed groundwater abstractions have been identified by the Environment Agency. One licensed groundwater abstraction will be directly affected by the Proposed Scheme. This is located at Bodymoor Heath Training Ground (Map CT-10-58, J5) and is used for spray irrigation. There are five other licensed groundwater abstractions within the study area.
- 3.3.8 One unlicensed water supply has been identified in the study area.
- 3.3.9 Table 4 summarises licensed groundwater abstractions within the study area.

Table 4: Licensed groundwater abstractions

Licence identifier (map reference number ¹¹ and Environment Agency reference)	Distance from route	Abstraction horizon	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Number of boreholes covered by licence	Purpose
Lea Marston Golf & Leisure Centre – Lagoon 03/28/16/0049 Map WR-02-020 (G5), located 1km east of Birmingham and Fazeley Canal viaduct no. 1	1,350m east of the route	Likely to be from mudstone of the Mercia Mudstone Group	5,000m ³	60m ³	1	Industrial, commercial and public services Golf courses Spray irrigation – direct
03/28/16/0088/1 Haunch Lane, Lea Marston, Sutton Coldfield – U/S Map WR-02-020 (G5), located 1km east of Birmingham and Fazeley Canal viaduct no. 1	1,290m east of the route	Likely to be from mudstone of the Mercia Mudstone Group	7,500m ³	100m ³	1	Industrial, commercial and public services Golf courses Spray irrigation – direct
CFA20-GWUA1 Borehole at Cuttle Mill Farm Map WR-02-020 (F5), located 140m south-west of Cuttle Mill viaduct	130m west of the route	Likely to be from mudstone of the Mercia Mudstone Group	Not Provided, less than 20m ³	Not Provided, less than 20m ³	1	Private water supply
MD/028/0016/001 Borehole at Bodymoor Heath Training Ground Map WR-02-020 (E5), located 40m west of Hunts Green viaduct	90m west of the route	Likely to be from mudstone of the Mercia Mudstone Group	7,300m ³	200m ³	1	Agriculture, general agriculture Spray irrigation – direct

¹¹ Map references taken from Volume 5: Map Book – Water resources, Map WR-02-020.

Licence identifier (map reference number ¹¹ and Environment Agency reference)	Distance from route	Abstraction horizon	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Number of boreholes covered by licence	Purpose
03/28/16/0083/1 Middleton Hall – Lagoon Map WR-02-020 (E5), located 600m east of Langley Brook viaduct	980m east of the route	Likely to be from mudstone of the Mercia Mudstone Group	11,400m ³	60m ³	1	Industrial, commercial and public services – extractive Process water
03/28/16/0047 Middleton Hall Pit, Middleton – Lagoon Map WR-02-020 (E5), located 1.2km east of Hunts Green	980m east of the route	Likely to be from mudstone of the Mercia Mudstone Group	1,910,000m ³	7,640m ³	1	Mineral washing
03/28/16/0022/G Church Farm, Middleton, Tamworth – Spring fed pool Map WR-02-020 (D6), located 1.2km east of Hunts Green	1,230m west of the route	Likely to be from mudstone of the Mercia Mudstone Group	13,638m ³	8,182m ³	1	Agriculture – spray irrigation – direct

3.3.10 Table 5 summarises permitted discharges to groundwater within the study area.

Table 5: Groundwater discharge environmental permits

Reference number and map reference ¹²	Permit identifier	Distance from route	Discharge type	Receiving water body
3/28/10/0814/1 Map WR-02-020 (G5), located 650m north-east of Curdworth viaduct	1465744	370m east of the route	Sewage effluent	Groundwater
3/28/16/0873/1 Map WR-02-020 (G5), located 1.2km north-east of Curdworth viaduct	1473138	1,000m east of the route	Sewage effluent	Groundwater
3/28/16/0871/1 Map WR-02-020 (G5), located 1.4km north-east of Curdworth viaduct	1473139	1,100m east of the route	Sewage effluent	Groundwater
3/28/16/0901/1 Map WR-02-020 (G5), located 1.4km north-east of Curdworth viaduct	1473176	1,300m east of the route	Sewage effluent	Groundwater

¹² Map references taken from map Volume 5: Map Book – Water resources, Map WR-02-020.

Reference number and map reference ¹²	Permit identifier	Distance from route	Discharge type	Receiving water body
3/28/16/2768 Map WR-02-020 (F4), located 1km east of Birmingham and Fazeley Canal viaduct	1473113	1,000m east of the route	Sewage discharges – final/treated effluent – not water company	Land/soakaway
T/16/14174/SG/1 Map WR-02-020 (F6), located within The Belfry Hotel, 1.1km north-west of Birmingham and Fazeley Canal viaduct	1465157	950m west of the route	Sewage effluent	Groundwater
WQ/72/1235/1 Map WR-02-020 (F6), located on golf course, 1.2km north-west of Birmingham and Fazeley Canal viaduct	1465215	610m west of the route	Sewage effluent	Groundwater
T/16/36363/SG Map WR-02-020 (F4), located 1.7km north-east of Birmingham and Fazeley Canal viaduct	36970931	1.400m east of the route (200m south-east of the Marston railhead)	Sewage discharges – final/treated effluent – not water company	Land/soakaway
Wq/72/1565 Map WR-02-020 (F4), located alongside the M42, 430m east of Bodymoor Heath	1472656	1,200m west of the route (100m north-west of the Marston railhead)	Sewage discharges – final/treated effluent – not water company	Land/soakaway
Wq/72/66 Map WR-02-020 (F4), located at The Cottage, 450m north-east of Bodymoor Heath	1472597	1,200m east of the route (300m north-west of the Marston railhead)	Sewage discharges – final/treated effluent – not water company	Land/soakaway
3/28/16/1683/1 Map WR-02-020 (E5), located at football ground, 310m north-east of Bodymoor Heath Lane overbridge	1465217	270m east of the route	Sewage effluent	Groundwater
T/16/36448/Tg Map WR-02-020 (E5), located 440m north-east of Bodymoor Heath Lane overbridge	43597978	300m east of the route	Sewage and trade combined – unspecified	Land/soakaway
Wq/72/77 Map WR-02-020 (E6), located 580m south-west of Langley Brook viaduct	1465218	420m west of the route	Sewage discharges – final/treated effluent – not water company	Land/soakaway
3/28/16/1791 Map WR-02-020 (D7), located 1.7km north-west of Langley Brook viaduct	1465349	1,200m south-west of the route	Sewage discharges – final/treated effluent – not water company	Land/soakaway

3.4 Groundwater/surface water interaction

3.4.1 Table 6 summarises springs, sinks and issues (locations where groundwater rises to the surface in a more diffuse way than at a spring) within the study area. Due to the

number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the Proposed Scheme, or within the calculated zone of influence, and therefore potentially affected by the Proposed Scheme, have been included in Table 6.

Table 6: Groundwater/surface water interaction

Location description and map reference ³³	Distance from route	Formation	Elevation	Comments
River Tame at Coleshill Sewage Works Map WR-02-020 (H6), will be crossed by Curdworth viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium
Minor tributary of River Tame at Coleshill Sewage Works Map WR-02-020 (H6), will be crossed by Curdworth viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium
Minor tributary of River Tame at Coleshill Sewage Works Map WR-02-020 (H6), will be crossed by Curdworth viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium
Drain at Coleshill Sewage Works Map WR-02-020 (H6), will be crossed by Curdworth viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by river terrace deposits	Not applicable	May receive baseflow near the route from Secondary A aquifer in the river terrace deposits
Sinks west of Spring Farm Map WR-02-020 (G6), located 600m west of Curdworth viaduct	700m west of the route	Mercia Mudstone bedrock overlain by alluvium superficial deposits	75mAOD	Water most likely recharges alluvium
Sinks south of Spring Farm Map WR-02-020 (G6), located 560m west of Curdworth viaduct	570m west of the route	Mercia Mudstone bedrock overlain by alluvium superficial deposits	75mAOD	Water most likely recharges alluvium
Issues at Spring Farm Map WR-02-020 (G6), located at 560m west of Curdworth viaduct	330m west of the route	Mercia Mudstone bedrock overlain by superficial River terrace deposits	75mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits

³³ Map references taken from Volume 5: Map Book – Water resources, Map WR-02-020 and Volume 5: Map Book – Ecology, Maps EC-04-056 to EC-04-058a.

Location description and map reference ¹³	Distance from route	Formation	Elevation	Comments
Spring at Spring Farm Map WR-02-020 (G6), located 600m west of Curdworth viaduct	750m west of the route	Mercia Mudstone bedrock overlain by superficial river terrace deposits and glaciolacustrine deposits	75mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Drain alongside Faraday Avenue Map WR-02-020 (G6), located 580m north of Curdworth viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by superficial head deposits, river terrace deposits and glaciolacustrine deposits	Not applicable	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Issues in the eastern corner of Sych Wood Map WR-02-020 (G5), 1.2km south east of the A4097 Kingsbury Road overbridge	800m east of the route	Mercia Mudstone bedrock overlain by superficial river terrace deposits	77mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Sinks east of Woodhouse Farm Map WR-02-020 (G5), located 900m south east of the A4097 Kingsbury Road overbridge	800m east of the route	Mercia Mudstone bedrock	78mAOD	Water most likely recharges the river terrace deposits
Issues near Hams Hall Sub Station Map WR-02-020 (G5), located 700m south east of the A4097 Kingsbury Road overbridge	380m east of the route	Mercia Mudstone bedrock	90mAOD	May receive groundwater from the Secondary B aquifer in the Mercia Mudstone bedrock
Issues south of Dunton Coppice Map WR-02-020 (G5), located 470m south east of the A4097 Kingsbury Road overbridge	400m east of the route	Mercia Mudstone bedrock	92mAOD	May receive groundwater from the Secondary B aquifer in the Mercia Mudstone bedrock
Pond Identifier 030-AA-166001 Map EC-04-056 (C7), located 180m south-west of the A4097 Kingsbury Road overbridge	110m west of the route	Mercia Mudstone bedrock overlain by superficial glaciolacustrine deposits	95mAOD	Unlikely to be groundwater dependent as situated upon Unproductive strata
Drain near Mullensgrove Farm Map WR-01-020 (E5), adjacent to Mullensgrove Farm, 250m north-east of the A4097 Kingsbury Road overbridge	75m east of the route	Mercia Mudstone bedrock overlain by superficial glaciofluvial deposits	Not applicable	May receive groundwater from the Secondary A aquifer in the superficial glaciofluvial deposits

Location description and map reference ¹³	Distance from route	Formation	Elevation	Comments
<p>Pond between Dunton Wood and Dunton Stables</p> <p>Map EC-04-056 (B5), located between Dunton Wood and Dunton Stables, 310m north-east of the A4097 Kingsbury Road overbridge</p>	85m east of the Leeds Spur	Mercia Mudstone bedrock	97mAOD	May receive groundwater from Secondary B aquifer in the Mercia Mudstone bedrock
<p>Pond north-west of Dunton Stables</p> <p>Map EC-04-056 (B5), north-west of Dunton Stables, 350m north-east of the A4097 Kingsbury Road overbridge</p>	90m east of the Leeds Spur	Mercia Mudstone bedrock	97mAOD	May receive groundwater from Secondary B aquifer in the Mercia Mudstone bedrock
<p>Issues located in Lea Marston</p> <p>Map WR-02-020 (G5), located in Lea Marston, 1.2km east of the M42 Marston box structure</p>	1,200m east of the route	Mercia Mudstone bedrock overlain by river terrace deposits	76mAOD	Likely to be an extended culvert Unlikely to receive groundwater
<p>Issues located in Lea Marston</p> <p>Map WR-02-020 (F4), located in Lea Marston, 1.2km east of the M42 Marston box structure</p>	1,100m east of the route	Mercia Mudstone bedrock overlain by river terrace deposits	75mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
<p>Birmingham and Fazeley Canal</p> <p>Map WR-01-020 (F5), crossed by the route at the Birmingham and Fazeley Canal viaduct</p>	Will be crossed by the route	Mercia Mudstone bedrock overlain by Head Deposits	Not applicable	Canal – therefore unlikely to be groundwater fed
<p>Sinks located in Marston</p> <p>Map WR-02-020 (F4), located in Marston, 1.6km east of the Birmingham and Fazeley Canal viaduct</p>	1700m east of the route	Mercia Mudstone bedrock overlain by river terrace deposits	70mAOD	Water likely recharges into the river terrace deposits
<p>Two ponds</p> <p>Map EC-04-057 (G5), will be crossed by embankment, 250m north of the Birmingham and Fazeley Canal viaduct</p>	Will be crossed by the route	Mercia Mudstone bedrock	75mAOD	May receive baseflow from secondary B aquifer

Location description and map reference ¹³	Distance from route	Formation	Elevation	Comments
Spring 600m north of Marston Map WR-02-020 (F4), 1.5km east of the Cuttle Mill underbridge	1500m east of the route	Mercia Mudstone bedrock overlain by alluvium	72mAOD	May receive groundwater from the Secondary A aquifer in the superficial alluvium
Pond at Cocksparrow House Map EC-04-057 (F3), 500m east of Cuttle Mill underbridge. Crossed by the Leeds Spur.	500m east of the route	Mercia Mudstone bedrock	80mAOD	Unlikely to be groundwater dependent as located on elevated topography
Minor tributary of Langley Brook Map WR-01-020 (C5), will be crossed by the route at the Cuttle Mill underbridge	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium
Issues 600m north of Marston Map WR-02-020 (F4), located 600m north of Marston, 1.4km east of the Cuttle Mill underbridge	1,500m east of the route	Mercia Mudstone bedrock and overlain alluvium	70mAOD	May receive groundwater from the Secondary B aquifer in the Mercia Mudstone bedrock or alluvium
Issues located alongside the M42 Map WR-02-020 (E4), located alongside the M42, 940m north-east of North Wood Embankment	950m east of the route	Mercia Mudstone bedrock and overlain alluvium	70mAOD	May receive groundwater from the Secondary B aquifer in the Mercia Mudstone bedrock or alluvium
Minor tributary of Langley Brook Map WR-01-020, (E5), crossed at North Wood South culvert	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium
Issues within Bodymoor Heath Map WR-02-020 (E4), within Bodymoor Heath, 750m east of North Wood underbridge	730m east of the route	Mercia Mudstone bedrock overlain by river terrace deposits	70mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Minor tributary of Langley Brook Map WR-01-020 (E5), crossed at Hunts Green underbridge	Will be crossed by the route	Mercia Mudstone bedrock overlain by river terrace deposits	Not applicable	May receive baseflow near the route from Secondary A aquifer in the river terrace deposits

Location description and map reference ¹³	Distance from route	Formation	Elevation	Comments
Pond within Bodymoor Heath Training Ground Map EC-04-057 (B7), located within Bodymoor Heath Training Ground, 100m north west of Hunts Green underbridge	90m west of the route	Mercia Mudstone bedrock overlain by river terrace deposits	72mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Drain running beneath the Bodymoor Heath Training Ground Map WR-01-020 (E5), runs beneath the Bodymoor Heath Training Ground, crossed 200m north of Hunts Green underbridge	Will be crossed by the route	Mercia Mudstone bedrock overlain by river terrace deposits	Not applicable	May receive baseflow near the route from Secondary A aquifer in the river terrace deposits
Issues within Coneybury Wood Map WR-02-020 (E5), located Within Coneybury Wood, 230m east of the A4091 Tamworth Road overbridge	200m east of the route	Mercia Mudstone bedrock overlain by river terrace deposits	70mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Issues within Coneybury Wood Map WR-02-020 (E5), located within Coneybury Wood, 500m east of the A4091 Tamworth Road overbridge	450m east of the route	Mercia Mudstone bedrock overlain by river terrace deposits	70mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Issues near Middleton Hall Map WR-02-020 (D5), located near Middleton Hall, 770m east of Langley Brook viaduct,	740m north-east of the route	Mercia Mudstone bedrock overlain by river terrace deposits	68mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits
Langley Brook Map WR-01-020 (D5), crossed at Langley Brook viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium
Issues within Middleton Park Map WR-02-020 (D5), located within Middleton Park, 670m north-east of Langley Brook viaduct	670m east of the route	Mercia Mudstone bedrock overlain by river terrace deposits and alluvium	68mAOD	May receive groundwater from the Secondary A aquifer in the superficial river terrace deposits or alluvium

Location description and map reference ¹³	Distance from route	Formation	Elevation	Comments
Spring located 600m west of Middleton Map WR-02-020 (D6), located 600m west of Middleton, 1.2km west of Langley Brook viaduct	1,100m south-west of the route	Mercia Mudstone bedrock	89mAOD	May receive groundwater from the Secondary B aquifer in the Mercia Mudstone bedrock
Issues north of Middleton Map WR-02-020 (D6), located 700m north-west of Langley Brook viaduct	480m south-west of the route	Mercia Mudstone bedrock overlain by Head	85mAOD	May receive groundwater from the Secondary B aquifer in the Mercia Mudstone bedrock or Secondary Undifferentiated aquifer in the Head Deposits
Gallows Brook Map WR-01-020 (D6), will be crossed by the route at Gallows Brook viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium
Issues located at the head of Gallows Brook Map WR-02-020 (D6), located at the head of Gallows Brook, 340m north-west of Gallows Brook viaduct	180m south-west of the route	Mercia Mudstone bedrock overlain by alluvium	83mAOD	May receive groundwater from the Secondary A aquifer in the superficial alluvium
Minor tributary of River Tame Map WR-02-020 (D6), crossed by the route at Drayton Bassett viaduct	Will be crossed by the route	Mercia Mudstone bedrock overlain by alluvium	Not applicable	May receive baseflow near the route from Secondary A aquifer in the alluvium

3.5 Water-dependent habitats

3.5.1 Table 7 summarises the water-dependent habitats within the study area. These have been identified from a review of Ordnance Survey (OS) mapping, aerial photography and from the following sources:

- information on designated and potential non-statutory local wildlife sites (LWS) from Warwickshire Biological Records Centre;
- information on statutory designated sites from Natural England; and
- information from ecological surveys carried out in support of the Environmental Impact Assessment (EIA).

3.5.2 The table identifies where a water dependency may exist but the assessment of impact on water-dependent ecology receptors is found in Volume 2, CFA Report 20, Section 7.

Table 7: Description of water dependent habitats

Location and map reference ¹⁴	Distance from route	Designation	Comments
Hams Hall Woodlands (Sych Wood assessed separately) Map EC-01-056 (E1), located approximately 450m south of Lea Marston	360m east of the route	LWS	Potentially groundwater dependent. Fed by headwater stream and lies within a valley on permeable superficial and bedrock deposits.
Sych Wood (Part of Hams Hall Woodlands) Map EC-01-056 (E2), located approximately 400m south-west of Lea Marston	770m east of the route	Ancient woodland	Unlikely to be groundwater or surface water dependent as no water features nearby.
Dunton Wood Map EC-01-056 (B5), located 900m north-west of Lea Marston	290m east of the route	LWS and ancient woodland	Unlikely to be groundwater or surface water dependent as there are no water features nearby and the woodland is on elevated topography.
Lea Marston Old Quarry Map EC-01-056 (B1), located approximately 450m north of Lea Marston	1,000m east of the route	LWS	Potentially groundwater dependent as citation states wet habitat and located at low topography on permeable superficial and bedrock deposits.
Lea Marston Lake EC-01-056 (C1), located 160m north-east of Lea Marston	1,300m east of the route	LWS	Potentially groundwater dependent. The receptor contains lakes and located at low topography on permeable superficial and bedrock deposits.
Mill Plantation and Lower Mill Plantation surrounding the fishing lakes at Cuttle Mill Fisheries Map EC-01-057 (G6), located 15km west of Marston	225m west of the route	Identified by ecology as wet habitat of concern	Potentially groundwater dependent. Described in the citation as wet woodland and situated upon permeable strata.
North Wood Map EC-01-057 (D5), located approximately 17km south-east of Hunts Green	Will be crossed by the route	LWS and Ancient woodland	Potentially groundwater dependent. Described in citation as wet woodland with a swamp present. On permeable strata within a valley.
Middleton Hall Farm Quarry Map EC-01-058 (H5), located approximately 400m east of Hunts Green	210m east of the route	Partial Ancient woodland Identified by ecology as wet habitat of concern	Likely to be groundwater supported. Issues feed directly into pools. Wet and on permeable strata.
Coneybury Wood, Middleton Map EC-01-058 (H4), located approximately 500m east of Hunts Green	250m east of the route	LWS and Ancient woodland	Potentially groundwater dependent. Identified in citation as naturally damp woodland with swampy vegetation. On permeable strata in a valley. Headwater stream present at the receptor.

¹⁴ Map references taken from Volume 5: Map Book – Ecology, Maps EC-01-056 to EC-01-058b.

Location and map reference ¹⁴	Distance from route	Designation	Comments
Roger's Coppice Map EC-01-058 located approximately 600m south-east of Middleton	260m west of the route	Ancient woodland	Unlikely to be groundwater or surface water dependent as there are no water features nearby and the woodland is on elevated topography.
Middleton Pool SSSI Map EC-01-058 located approximately 11km east of Middleton	150m east of the route	SSSI	Likely to be groundwater supported. General area is wet and situated upon permeable strata. Citation states the following: – "Operations likely to damage the special interest" include "The changing of water levels and tables and water utilisation" and "the erection of permanent or temporary structures, or the undertaking of engineering works, including drilling".

4 **Site-specific assessments**

4.1 **Surface water**

4.1.1 Table 8 summarises the potential impacts and effects to surface water.

Table 8: Summary of potential impacts to surface water

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
River Tame downstream of Curdworth Bridge. (SWC-CFA20-001)	Very high	River Tame west viaduct Water Orton viaduct no. 2 Watton Lane embankment Watton House north embankment Drainage outfall Balancing pond River Tame utility over bridge Realignment A4097 Kingsbury Road	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency Pollution Prevention Guidelines (PPGs) – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

¹⁵ Map references taken from Volume 5: Map Books – water resources, Maps WR-01-033 and WR-01-034.¹⁶ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

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Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from the railway)	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages. Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Realigned A4097 Kingsbury Road	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages.</p> <p>Initial water quality tests (HAWRAT from the Design Manual for Roads and Bridges, DMRB¹⁷) have shown that mitigation is required to offset potential impacts to the water environment (particularly to address copper concentrations and the dispersal of sediments).</p>	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation

¹⁷ DMRB (2009), Volume 11 Section 3 Part 10 HD45/09 Road Drainage and the Water Environment.

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Surface water feature/ receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of the River Tame south-east of Spring Farm and the M42. (SWC-CFA20-002)	Moderate	Water Orton viaducts no. 1 Curdworth viaduct Balancing pond Drainage outfall	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from the railway)	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages. Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation

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Surface water feature/ receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of River Tame west of Edison Road. (SWC-CFA20-003)	Moderate	Curdworth viaducts Balancing pond Drainage outfall Scour protection works local to outfall along watercourse and re-profiling and vegetation/debris clearance in watercourse Water Orton viaducts no. 1	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination of polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
		Scour protection works local to outfall along watercourse and re-profiling and vegetation/debris clearance in watercourse.	Moderate adverse	Works may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourse.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation
Drain crossing on Newlands Farm. (SWC-CFA20-004)	Moderate	Curdworth retaining walls Faraday Avenue embankment Balancing pond	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Drain at Faraday Avenue. (SWC-CFA20-005)	Moderate	Curdworth retaining walls Faraday Avenue embankment Balancing pond Drainage outfall Faraday Avenue underbridge Realigned Hams Lane	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from the railway).	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages. Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
		Drainage outfall (from Hams Lane Assumed to have mitigation and outfall to drain at Faraday Avenue).	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation
		Drainage outfall (from Faraday Avenue Assumed to have mitigation and outfall to drain at Faraday Avenue).	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages. Initial water quality tests (HAWRAT from the DMRB ¹⁸) have shown that mitigation is required to offset potential impacts to the water environment (particularly to address copper concentrations and the dispersal of sediments).	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

¹⁸ DMRB (2009), Volume 11 Section 3 Part 10 HD45/09 Road Drainage and the Water Environment.

Surface water feature/ receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Birmingham and Fazeley Canal crossing at White Bridge Lower Mill Plantation. (SWC-CFA20-006)	Moderate	Birmingham and Fazeley Canal viaduct North Wood embankment Balancing pond Drainage outfall Scour protection works local to outfall.	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination of polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation

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Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from railway)	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages. Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Pond at Cuttle Mill Fishery. (SWC-CFA20-007)	Refer to ecology Volume 2, CFA Report 20, Section 7 for impact assessment.								
Pond at Cuttle Mill Fishery (SWC-CFA20-008)	Refer to ecology Volume 2, CFA Report 20, Section 7 for impact assessment.								
Tributary of Langley Brook at Cuttle Mill Fishery. (SWC-CFA20-	Moderate	North Wood embankment Wetland pond Scour protection works local to outfall, along	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
009)		with channel bed re-profiling and vegetation/debris clearance in watercourse.		<p>spillage of fuels and other hazardous liquids;</p> <p>The mobilisation of contaminants following disturbance of contaminated ground or groundwater;</p> <p>Uncontrolled site run-off.</p> <p>In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination of polluting materials.</p>	<p>Mitigation measures outlined in draft CoCP.</p> <p>Water management implemented during earthworks operation.</p> <p>Temporary site drainage designed to retain surface run-off within site boundary.</p> <p>Grey water systems used at main and construction compounds</p>				

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Surface water feature/ receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
<p>Tributary of River Tame at Heath House Farm</p> <p>Map WR-01-033 (C4)</p> <p>Note: watercourse does not cross the route</p>	Moderate	<p>Marston Railhead</p> <p>Balancing pond</p> <p>Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse.</p>	Moderate adverse	<p>Deterioration of water quality due to:</p> <p>Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids;</p> <p>The mobilisation of contaminants following disturbance of contaminated ground or groundwater;</p> <p>Uncontrolled site run-off.</p> <p>In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination of polluting materials.</p>	<p>Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works.</p> <p>Mitigation measures outlined in draft CoCP.</p> <p>Water management implemented during earthworks operation.</p> <p>Temporary site drainage designed to retain surface run-off within site boundary.</p> <p>Grey water systems used at main and construction compounds</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	None required	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Temporary)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Trib of Langley Brook at Middleton House Farm. (SWC-CFA20-010)	Moderate	<p>North Wood embankment</p> <p>North Wood underbridge</p> <p>Balancing ponds</p> <p>Drainage outfall</p> <p>Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse.</p>	Moderate adverse	<p>Deterioration of water quality due to:</p> <p>Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids. The mobilisation of contaminants following disturbance of contaminated ground or groundwater.</p> <p>Through uncontrolled site run-off.</p> <p>In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.</p>	<p>Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works.</p> <p>Mitigation measures outlined in draft CoCP.</p> <p>Water management implemented during earthworks operation.</p> <p>Temporary site drainage designed to retain surface run-off within site boundary.</p> <p>Grey water systems used at main and construction compounds.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	None required	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Temporary)
		Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse	Moderate adverse	Works may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	None required	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		North Wood underbridge	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	<p>Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks.</p> <p>Improvements along watercourse either side of culvert, sufficient to maintain open length and watercourse gradient.</p>	<p>Minor to Minor beneficial</p> <p>Slight to Slight beneficial</p> <p>(not significant)</p>	None required	<p>Minor to Minor beneficial</p> <p>Slight to Slight beneficial</p> <p>(not significant)</p>	Construction (Permanent)
		Drainage outfall (from the railway)	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	None required	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation
Tributary of Langley Brook at Primrose Cottage. (SWC-CFA20-011)	Moderate	Hunts Green underbridge Realigned Bodymoor Heath Lane Bodymoor Heath Lane overbridge Drainage outfall (from road) North Wood embankment Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse.	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids. The mobilisation of contaminants following disturbance of contaminated ground or groundwater. Uncontrolled site run-off. In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/ receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (associated with realignment of Bodymoor Heath Lane. Drainage from road assumed to join tributary of Langley Brook at Primrose Cottage).	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
		Hunts Green underbridge	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks. Improvements along watercourse either side of culvert, sufficient to maintain open length and watercourse gradient.	Minor to Minor beneficial Slight to Slight beneficial (not significant)	None required	Minor to Minor beneficial Slight to Slight beneficial (not significant)	Construction (Permanent)
		Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse.	Moderate adverse	Works may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Surface water feature/ receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation
Drain feeder to Langley Brook at Brick Kiln Lane. (SWC-CFA20-012)	Moderate	Existing drain is culverted under Bodymoor Heath Football Training Ground so there will be no impacts from the scheme.	Negligible	None – watercourse already culverted.	None required.	Negligible Neutral (not significant)-		Negligible Neutral (not significant)-	Construction (Temporary)

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Surface water feature/ receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Langley Brook crossing at Middleton Pool Walkers Spinney. (SWC-CFA20-013)	High	Langley Brook viaduct Balancing ponds Drainage outfalls Existing culvert under A4091 lengthened and mammal ledge added Realigned Church Lane Church Lane embankment Middleton Pool embankment Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse. A4091 Tamworth Road overbridge	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids. The mobilisation of contaminants following disturbance of contaminated ground or groundwater. Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and construction compounds	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from railway)	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages. Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
		Drainage outfall (associated with realignment of Church Lane Drainage from road assumed to join Langley Brook).	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (associated with A4091 Tamworth Road overbridge Drainage from road assumed to join Langley Brook).	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages. Initial water quality tests (HAWRAT from the DMRB ¹⁹) have shown that mitigation is not required to offset potential impacts to the water environment.	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation

¹⁹ DMRB (2009), Volume 11 Section 3 Part 10 HD45/09 Road Drainage and the Water Environment.

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Existing culvert under A4091 Tamworth Road lengthened and mammal ledge added.	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Minor to Minor beneficial Slight to Slight beneficial (not significant)	None required	Minor to Minor beneficial Slight to Slight beneficial (not significant)	Construction (Permanent)
		Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse	Moderate adverse	Works may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Gallows Brook east of Upper House Farm. (SWC-CFA20-014)	Moderate	Gallows Brook culvert No 1 Trickley Coppice embankment 172-L1 Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse.	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
				the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination by polluting materials.	construction compounds				
		Gallows Brook culvert no 1	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Minor to Minor beneficial Slight to Slight beneficial (not significant)	None required	Minor to Minor beneficial Slight to Slight beneficial (not significant)	Construction (Permanent)
		Scour protection works local to outfall, along with channel bed re-profiling and vegetation/debris clearance in watercourse.	Moderate adverse	Works may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Surface water feature/receptor ¹⁵	Value of surface water feature ¹⁶	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of River Tame at Trickley Coppice. (SWC-CFA20-015)	Moderate	Drayton Bassett viaduct Trickley Coppice embankment	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids. The mobilisation of contaminants following disturbance of contaminated ground or groundwater. Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

4.2 Groundwater

4.2.1 Following the methodology outlined in the SMR addendum see Volume 5: Appendix CT-001-000/2, the hydraulic conductivity values; obtained from available literature values, were used in conjunction with professional judgment to estimate the maximum extent of the zone of influence that is likely to be produced when dewatering of a cutting occurs. The hydraulic conductivity values used are generally in the high range of literature values to provide a realistic factor of safety to the estimated zone of influence. Based on this worst case assumption, the zone of influence is likely to be overestimated, however for the purpose of this preliminary assessment, this approach is considered to be acceptable.

4.2.2 Aquifer properties used for estimating the zone of influence can be found in Table 9.

Table 9: Aquifer Properties

Lithology	Hydraulic conductivity value	References
Mercia Mudstone Group-Mudstone	0.1m/d	Hiscock 2005 ²⁰
Glaciofluvial deposits Sand and Gravel	86.4m/d	Hiscock 2005
River terrace deposits	51.8m/d	An average of sand values from Domenico and Schwartz 1990 ²¹
Glaciolacustrine Deposits – clay and silt	0.0000864m/d	Hiscock 2005

4.2.3 The zone of influence for the dewatering of the cuttings along the route was calculated at frequent intervals as topography, geology and track level change, using the methodology outlined in the SMR addendum see Volume 5: Appendix CT-001-000/2 and the properties in Table 9. Table 10 summarises the estimated zone of influence within the study area for each of the cuttings. In each case, the maximum zone of influence value reported has not been applied to the whole extent of the cutting; it is purely illustrative of the worst-case conditions at its deepest section.

Table 10: Maximum extent of the zone of influence in the Curdworth to Middleton study area

Cutting	Geology	Maximum drawdown within cutting	Maximum zone of influence	Comments
Dunton cutting	Mercia Mudstone – mudstone	15m	48.41m	
	Glaciolacustrine Deposits, Mid Pleistocene – clay and silt	10m	0.95m	
Curdworth cutting	Mercia Mudstone – Mudstone	11m	35.50m	
	Glaciolacustrine Deposits, Mid Pleistocene – clay and silt	10m	0.95m	
	Glaciofluvial Deposits, Mid Pleistocene – sand and gravel	10m	600m	Zone of influence confined to the extent of the superficial deposit.

²⁰ Hiscock, K.M. (2005), *Hydrogeology: Principles and Practice*, Blackwell Science Ltd, Oxford.

²¹ Domenico P.A. and F.W. Schwartz (1990), *Physical and Chemical Hydrogeology*, John Wiley & Sons, New York.

Cutting	Geology	Maximum drawdown within cutting	Maximum zone of influence	Comments
Middleton Pool cutting	Mercia Mudstone – Mudstone	6m	19.36m	
Coppice Lane cutting	River Terrace Deposits	3m	220.45m	
	River Terrace Deposits	2m	146.97m	

4.2.4 Table 11 summarises the potential impacts to groundwater, abstractions, water dependent habitats and groundwater/surface water interactions.

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Table 11: Summary of potential impacts to groundwater, abstractions, water dependent habitats and groundwater/ surface water interactions

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Aquifers								
Bedrock Secondary B aquifer in Mercia Mudstone (moderate).	Various (route-wide) e.g. Curdworth cutting Dunton cutting Marston Farm cutting Marston railhead M42 Marston Box Structure	Major adverse	Parts of the Marston railhead are located directly upon the Mercia Mudstone Secondary B aquifer. The construction of the railhead and activities associated with it could be a source of contamination. The large area of the railhead and the increase in impermeable surfaces could reduce infiltration to groundwater. Dewatering of M42 Marston box structure has potential to reduce groundwater levels in the aquifer. Potential for contaminants to enter groundwater during construction (e.g. suspended solids, leaks from machinery).	Three retaining walls have been included into the design. This will constrain the zone of influence to the extents of the cutting and prevent a decrease in groundwater level in the Secondary B aquifer. Contamination control measures as required by the draft CoCP Section 16. SuDS such as infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent if continuous dewatering is required)
Superficial Secondary A aquifer in alluvium (moderate).	Capper's Lane viaduct Pyford Brook viaduct	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

²² Map references taken from Volume 5: Map Book – water resources, Map WR-02-020 and Volume 5: Map Book – Ecology, Maps EC-01 to EC-04.

²³ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Superficial Secondary A aquifer in Glaciofluvial Deposits (moderate).	Various (route-wide) e.g. Curdworth cutting Marston Farm cutting M42 Marston Box Structure	Major adverse	Dewatering of M42 Marston box structure has potential to reduce groundwater levels in aquifer. Possible impediment of groundwater flow through unit due to retained excavation.	A retaining wall along the Curdworth cutting has been included into the design. This will limit the zone of influence to the extents of the cutting and prevent a decrease in groundwater level in the Secondary B aquifer. Contamination control measures as required by the draft CoCP Section 16. SuDS to facilitate groundwater recharge. These should not be placed on the western side of the route as there is a possibly risk of groundwater flooding occurring as a result.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
Superficial Secondary A aquifer in river terrace deposits (moderate).	Various (route-wide)	Minor adverse	Lowering of groundwater levels to facilitate the cuttings. Long-term dewatering in the areas of cutting may be required.	None required	Minor Slight (not significant)	None required	Minor Slight (not significant)	Construction (Temporary)

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Superficial Secondary (undifferentiated) aquifer in the head (moderate).	Marston railhead	Moderate adverse	Parts of the Marston railhead are located directly upon the head Secondary aquifer. The construction of the railhead and activities associated with it could be a source of contamination. The large area of the railhead and the increase in impermeable surfaces could reduce infiltration to groundwater.	Contamination control measures as required by the draft CoCP Section 16. SuDS such as infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Abstractions								
Abstraction: 03/28/16/0049 (moderate) WR-02-020 (G5), located 1km east of Birmingham and Fazeley Canal viaduct no. 1.	Dunton Wood embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Abstraction: 03/28/16/0088/1 (moderate) WR-02-020 (G5), located 1km east of Birmingham and Fazeley Canal viaduct no. 1.	Leeds spur diveunder M42 Marston box structure	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Abstraction: MD/028/0016/001 (moderate) WR-02-020 (E5), located 40m west of Hunts Green viaduct.	Bodymoor Heath embankment	Major adverse	This abstraction is within the land required for the construction and operation of the Proposed Scheme, therefore this abstraction is likely to be lost to the scheme.	Decommission borehole and provide alternative water supply.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Abstraction: 03/28/16/0083/1 (moderate) WR-02-020 (E5), located 600m east of Langley Brook viaduct.	Bodymoor Heath embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Abstraction: 03/28/16/0047 (moderate) WR-02-020 (E5), located 1.2km east of Hunts Green.	Bodymoor Heath embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Abstraction: 03/28/16/0022/G (moderate) WR-02-020 (D64), located 1.2km east of Hunts Green.	Trickle Coppice embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Water dependent habitats								
Hams Hall Woodlands (moderate) Map EC-01-056, (E1), located approximately 450m south of Lea Marston.	Curdworth cutting	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Sych Wood (part of Hams Hall Woodlands) (high). Map EC-01-056, (E2), located approximately 400m south-west of Lea Marston.	Curdworth cutting M42 Marston box structure	Minor adverse	Possible reduction in groundwater levels at receptor as a result of dewatering of the M42 Marston box structure and possible inhibited groundwater flow through superficial deposits.	SuDS in the form of infiltration trenches will be located on the eastern side of the route to facilitate groundwater recharge. Draft CoCP measures to avoid transmission of potential contamination to receptor via groundwater.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Dunton Wood (high) Map EC-01-056, (B5), located 900m north-west of Lea Marston.	Curdworth cutting	Negligible	Receptor assessed unlikely to be groundwater dependent.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Lea Marston Old Quarry (moderate) Map EC-01-056, (B1), located approximately 450m north of Lea Marston.	Curdworth cutting Marston railhead	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Lea Marston Lake (moderate) EC-01-056, (C1), located 160m north-east of Lea Marston.	Curdworth cutting Marston railhead	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Mill Plantation and Lower Mill Plantation surrounding the fishing lakes at Cuttle Mill Fisheries (moderate). Map EC-01-057, (G6), located 15km west of Marston.	Mill Pool embankment	Minor adverse	Access track to be constructed along perimeter of receptor. This could reduce infiltration to receptor.	None required	Minor Slight (not significant)	None required	Minor Slight (not significant)	Construction (Temporary)
North Wood (high) Map EC-01-057, (D5), located approximately 17km south-east of Hunts Green.	North Wood embankment	Minor adverse	Receptor is crossed by the route. Works in the vicinity could reduce soil infiltration and impact the groundwater quality.	SuDS in the form of infiltration trenches will be located alongside the route to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Middleton Hall Farm Quarry, partial ancient woodland (moderate). Map EC-01-058, (H5), located approximately 400m east of Hunts Green.	Bodymoor Heath embankment Middleton Pool cutting	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Coneybury Wood, Middleton (high). Map EC-01-058, (H4), located approximately 500m east of Hunts Green.	Middleton Pool cutting	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Roger's Coppice (high) Map EC-01-058, located approximately 600m south-east of Middleton.	Middleton Pool cutting	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Middleton Pool SSSI (high). Map EC-01-058, located approximately 11km east of Middleton.	Langley Brook viaduct Church Lane embankment	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Groundwater/ Surface Water Interactions								
River Tame at Coleshill Sewage Works (very high). Map WR-02-020 (H6), will be crossed by Curdworth viaduct.	Watton House south embankment River Tame west viaduct Curdworth viaduct	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Minor tributary of River Tame at Coleshill Sewage Works (moderate). Map WR-02-020 (H6), will be crossed by Curdworth viaduct.	River Tame west viaduct Curdworth viaduct	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Minor tributary of River Tame at Coleshill Sewage Works (moderate). Map WR-02-020 (H6), will be crossed by Curdworth viaduct.	River Tame west viaduct Curdworth viaduct	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Drain at Coleshill Sewage Works (low). Map WR-02-020 (H6), will be crossed by Curdworth viaduct.	Curdworth viaduct Faraday Avenue embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Sinks west of Spring Farm (moderate). Map WR-02-020 (G6), located 600m west of Curdworth viaduct.	Curdworth viaduct Curdworth retaining wall Faraday Avenue embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Sinks south of Spring Farm (moderate). Map WR-02-020 (G6), located 560m west of Curdworth viaduct.	Curdworth viaduct Curdworth retaining wall Faraday Avenue embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues at Spring Farm (moderate). Map WR-02-020 (G6), located at 560m west of Curdworth viaduct.	Curdworth viaduct Curdworth retaining wall Faraday Avenue embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Spring at Spring Farm (moderate). Map WR-02-020 (G6), located 600m west of Curdworth viaduct.	Curdworth retaining wall Faraday Avenue embankment	Negligible	Not located within ROI therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Drain alongside Faraday Avenue (low). Map WR-02-020 (G6), located 580m north of Curdworth viaduct.	Faraday Avenue embankment Curdworth retaining wall	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Issues in the eastern corner of Sych Wood (moderate). Map WR-02-020 (G5), 1.2km south east of the A4097 Kingsbury Road overbridge.	Dunton cutting	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Sinks east of Woodhouse Farm (moderate). Map WR-02-020 (G5), located 900m south east of the A4097 Kingsbury Road overbridge.	Dunton cutting Leeds spur Down underbridge	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues near Hams Hall Sub Station (moderate). Map WR-02-020 (G5), located 700m south east of the A4097 Kingsbury Road overbridge.	Dunton cutting Leeds spur diveunder	Moderate	Potential loss of groundwater flow from issues due to dewatering of cutting for M42 Marston box structure. Potentially impeded flow from west of route across retaining wall in river terrace deposits.	SuDS in the form of infiltration trenches will be located on the eastern side of the route to facilitate groundwater recharge. Discharge extracted water into the watercourse which the issues supply.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
Issues south of Dunton Coppice (moderate). Map WR-02-020 (G5), located 470m south east of the A4097 Kingsbury Road overbridge.	Curdworth cutting Leeds spur diveunder M42 Marston box structure	Moderate	Potential loss of groundwater flow from issues due to dewatering of cutting for M42 Marston box structure. Potentially impeded flow from west of route across retaining wall in river terrace deposits.	SuDS in the form of infiltration trenches will be located on the eastern side of the route to facilitate groundwater recharge.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Pond (low) Map EC-04-056 (C7), located 180m south-west of the A4097 Kingsbury Road overbridge.	Curdworth cutting Leeds spur diveunder	Major adverse	Pond assumed to be removed during construction of the Proposed Scheme.	Refer to ecology Volume 2, CFA Report 20, Section 7				
Drain near Mullensgrove Farm (low). Map WR-01-020 (E5), 250m north-east of the A4097 Kingsbury Road overbridge.	Curdworth cutting Leeds spur diveunder	Major adverse	Drain assumed to be removed during construction of the proposed scheme.	Located within the zone of influence therefore dewatering could reduce groundwater levels which may have an adverse impact on the watercourse. Reduced infiltration could locally reduce groundwater levels. However this is likely to be minimal and temporary.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Pond located between Dunton Wood and Dunton Stables (low). Map EC-04-056 (B5), 310m north-east of the A4097 Kingsbury Road overbridge.	Curdworth cutting Leeds spur diveunder Dunton Wood embankment	Major adverse	Pond assumed to be removed during construction of the Proposed Scheme.	Refer to ecology Volume 2, CFA Report 20, Section 7				
Pond north-west of Dunton Stables (low). Map EC-04-056 (B5), 350m north-east of the A4097 Kingsbury Road overbridge.	Mill Pool embankment Leeds spur diveunder	Major adverse	Pond assumed to be removed during construction of the Proposed Scheme.	Refer to ecology Volume 2, CFA Report 20, Section 7				

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Issues located in Lea Marston (moderate). Map WR-02-020 (G5), 1.2km east of the M42 Marston box structure.	Dunton Wood embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues located in Lea Marston (moderate). Map WR-02-020 (F4), 1.2km east of the M42 Marston box structure.	Birmingham and Fazeley Canal viaduct no. 2	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Birmingham and Fazeley Canal (high). Map WR-01-020 (F5), crossed by the route at the Birmingham and Fazeley Canal viaduct.	Marston railhead Leeds spur diveunder Birmingham and Fazeley Canal viaduct no. 1 Birmingham and Fazeley Canal viaduct no. 2 Curdworth cutting	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Sinks located in Marston (moderate). Map WR-02-020 (F4), 1.6km east of the Birmingham and Fazeley Canal viaduct.	Birmingham and Fazeley Canal viaduct no. 2 Kingsbury Road mid-point auto-transformer station Mill Pool embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Two ponds (low) Map EC-04-057 (G5), 250m north of the Birmingham and Fazeley Canal viaduct.	Fradley Avenue embankment	Major adverse	Pond assumed to be removed during construction of the Proposed Scheme.	Refer to ecology Volume 2, CFA Report 20, Section 7				
Spring 600m north of Marston (moderate). Map WR-02-020 (F4), located 1.5km east of the Cuttle Mill underbridge.	Mill Pool embankment Cuttle Mill viaduct	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond at Cocksparrow House (low). Map EC-04-057 (F3), located 500m east of Cuttle Mill underbridge. Crossed by the Leeds Spur.	Marston Farm cutting Marston railhead	Major adverse	Pond assumed to be removed during construction of the Proposed Scheme.	Refer to ecology Volume 2, CFA Report 20, Section 7.				

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Minor tributary of Langley Brook (moderate). Map WR-01-020 (C5), will be crossed by the route at the Cuttle Mill underbridge.	Mill Pool embankment Cuttle Mill viaduct	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues 600m north of Marston (moderate). Map WR-02-020 (F4), located 1.4km east of the Cuttle Mill underbridge.	Cuttle Mill viaduct North Wood embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues located alongside the M42 (moderate). Map WR-02-020 (E4), 940m north-east of North Wood Embankment.	Marston railhead North Wood embankment North Wood South culvert	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Minor tributary of Langley Brook (moderate). Map WR-01-020, (E5), crossed at North Wood South culvert.	North Wood embankment North Wood South culvert	Negligible	Stream to be culverted beneath Proposed Scheme. Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Issues within Bodymoor Heath (moderate). Map WR-02-020 (E4), 750m east of North Wood underbridge.	North Wood viaduct Middleton House Farm embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Minor tributary of Langley Brook (moderate). Map WR-01-020 (E5), crossed at Hunts Green underbridge.	Middleton House Farm embankment Hunts Green viaduct Bodymoor Heath embankment	Negligible	Stream to be culverted beneath Proposed Scheme. Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond within Bodymoor Heath Training Ground (low). Map EC-04-057 (B7), located 100m north west of Hunts Green underbridge.	Hunts Green viaduct Bodymoor Heath embankment	Major adverse	Pond assumed to be removed during construction of the Proposed Scheme.	Refer to ecology Volume 2, CFA Report 20, Section 7				
Drain running beneath the Bodymoor Heath Training Ground (low). Map WR-01-020 (E5), crossed 200m north of Hunts Green underbridge	North Wood South culvert Bodymoor Heath embankment	Negligible	Drain to be culverted beneath Proposed Scheme. Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Issues within Coneybury Wood (moderate). Map WR-02-020 (E5), located 230m east of the A4091 Tamworth Road overbridge.	Bodymoor Heath embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues within Coneybury Wood (moderate). Map WR-02-020 (E5), located 500m east of the A4091 Tamworth Road overbridge.	Middleton Pool cutting	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues near Middleton Hall (moderate). Map WR-02-020 (D5), located 770m east of Langley Brook viaduct.	Middleton Pool embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Langley Brook (high) Map WR-01-020 (D5), crossed at Langley Brook viaduct.	Langley Brook viaduct	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues within Middleton Park (moderate). Map WR-02-020 (D5), located 670m north-east of Langley Brook viaduct.	Church Lane embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²² (and value ²³)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation	Residual effect	Duration of effect
Spring located 600m west of Middleton (moderate). Map WR-02-020 (D6), 1.2km west of Langley Brook viaduct.	Coppice Lane cutting	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues north of Middleton (moderate) Map WR-02-020 (D6), located 700m north-west of Langley Brook viaduct.	Trickley Coppice embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Gallows Brook (moderate) Map WR-01-020 (D6), will be crossed by the route at Gallows Brook viaduct.	Trickley Coppice embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues located at the head of Gallows Brook (moderate). Map WR-02-020 (D6), 340m north-west of Gallows Brook viaduct.	Trickley Coppice embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Minor tributary of River Tame (moderate). Map WR-02-020 (D6), crossed by the route at Drayton Bassett viaduct.	Gallows Brook North culvert Trickley Coppice embankment	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

5 References

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